

## Preliminary results of a more accurate measurement of the radiative $4^+$ to $2^+$ transition in $^8\text{Be}$

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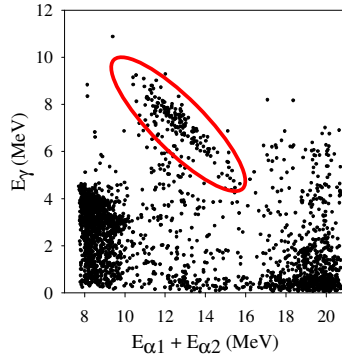
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The direct observation of the  $4^+$  to  $2^+$  gamma transition in  $^8\text{Be}$  provided the first electromagnetic signature of its dumbbell like shape [1]. However the large error  $\sim 30\%$  in the measured  $^4\text{He}+^4\text{He}$  radiative capture cross section did not allow a stringent test of nuclear structure models. The aim of the present measurement was to improve the accuracy by about a factor of 3 so that it could be compared with predictions of the alpha cluster model and *ab initio* calculations which differ by  $\sim 20\%$ . This was done by improving the  $2\text{-}\alpha$  detection through the use of a  $500\ \mu\text{m}$  thick double sided segmented silicon strip detector with  $2\times 16\ \theta$  strips and  $16\ \phi$  strips, a 38 BGO detector array for  $\gamma$ -rays, two heavy-met shields surrounding the  $1\ \text{mg}/\text{cm}^2$  kapton foils (isolating the gas target from the beam line vacuum) to reduce the beam induced  $4.44\ \text{MeV}$   $\gamma$ -ray background and making the measurement at 4 beam energies straddling the  $4^+$  resonance. A 2D spectrum of  $E_{\alpha_1}+E_{\alpha_2}$  vs  $E_\gamma$ , extracted from the event by event data for  $E_\alpha = 22.5\ \text{MeV}$ , is shown in Fig. 1. A band with  $E_\gamma \sim 7.5\ \text{MeV}$  and  $E_{\alpha_1}+E_{\alpha_2} \sim 13\ \text{MeV}$  corresponds to the radiative capture events of interest. The preliminary results of the measurement at the 4 beam energies are shown in Table 1. The  $B(E2)$  value for the  $4^+$  to  $2^+$  extracted from the on-resonance cross section agrees with the cluster model calculation [2] but differs from the earlier *ab initio* calculations [3]. A more precise *ab initio* calculation is awaited [4].



$E_\alpha$ (MeV)	$\sigma_\gamma$ (nb)
19.2	$85 \pm 10$
22.5	$134 \pm 14$
24.7	$103 \pm 10$
28.9	$< 32$

Fig. 1: 2D plot of  $E_{\alpha_1}+E_{\alpha_2}$  vs  $E_\gamma$  Table 1: Radiative capture cross section for 4 beam energies.

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